A verified spider bite and a review of the literature confirm Indian ornamental tree spiders (Poecilotheria species) as underestimated theraphosids of medical importance

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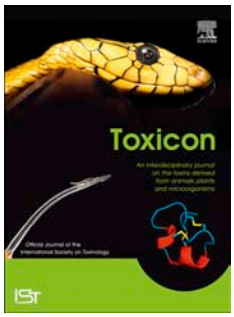
DOI: https://doi.org/10.1016/j.toxicon.2013.10.032

Accepted Manuscript



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PII: S0041-0101(13)00418-2

DOI: 10.1016/j.toxicon.2013.10.032

Reference: TOXCON 4728

To appear in: *Toxicon*

Received Date: 10 August 2013

Revised Date: 28 September 2013

Accepted Date: 31 October 2013

Please cite this article as: Fuchs, J., von Dechend, M., Mordasini, R., Ceschi, A., Nentwig, W., A verified spider bite and a review of the literature confirm Indian ornamental tree spiders (*Poecilotheria* species) as underestimated theraphosids of medical importance, *Toxicon* (2013), doi: 10.1016/j.toxicon.2013.10.032.

A verified spider bite and a review of the literature confirm Indian ornamental tree spiders (*Poecilotheria* species) as underestimated theraphosids of medical importance

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Abstract

Literature on bird spider or tarantula bites (Theraphosidae) is rare. This is astonishing as they are coveted pets and interaction with their keepers (feeding, cleaning the terrarium or taking them out to hold) might increase the possibility for bites. Yet, this seems to be a rare event and might be why most theraphosids are considered to be harmless, even though the urticating hairs of many American species can cause disagreeable allergic reactions. We are describing a case of a verified bite by an Indian ornamental tree spider (*Poecilotheria regalis*), where the patient developed severe, long lasting muscle cramps several hours after the bite. We present

a comprehensive review of the literature on bites of these beautiful spiders and conclude that a delayed onset of severe muscle cramps, lasting for days, is characteristic for *Poecilotheria* bites. We discuss *Poecilotheria* species as an exception from the general assumption that theraphosid bites are harmless to humans.

Keywords: Poecilotheria regalis, tarantula, Theraphosidae, muscle cramps

1. Introduction

Bird spiders (Theraphosidae), also called tarantulas, are coveted pets due to their size, easy keeping or beautiful colouring. They are considered to be harmless, although the hairs of many species can cause highly disagreeable allergic reactions and irritation of skin, eyes and respiratory tract (Blaikie et al. 1997; Watts et al. 2000; Choi et al. 2003; Spraul et al. 2003). Literature on theraphosid bites is rare (Schmidt 1989; De Haro & Jouglard 1998; Takaoka et al. 2001; Isbister et al. 2003; Ahmed et al. 2009). It is legal in Switzerland to own pet spiders and their owners are not obligated to inform the county of their existence, unlike the compulsory registration for snakes or other reptiles. So there is no information as to what species can be found in the terrariums throughout the country. There might even be highly toxic *Atrax*, *Hadronyche*, *Phoneutria* or *Latrodectus* species, which caused fatal issues in the past (Nentwig & Kuhn-Nentwig 2013), in some of the terrariums as well as many different species of theraphosids. While bites by theraphosids in general are considered to be rather harmless (Lucas et al. 1994; Isbister et al. 2003), the Swiss Toxicological Information Centre (STIC) has received 10 calls about bites by *Poecilotheria* sp. since 1995, a frequently kept theraphosid genus of colourful spiders, with two written feedbacks, both concerning *P. ornata*, with detailed information about the clinical course by the treating physicians, apart from the case presented here.

Most of the 16 *Poecilotheria* species currently listed for this genus (Platnick 2013) are common pet spiders. They are tree-inhabiting species, restricted to India and Sri Lanka. *P. regalis* has a body length of about 6-8 cm and the leg span measures up to 16 cm from one tip of a leg to the other; the cheliceral fang length is 10 mm in adult females. It is beautifully coloured in blue, yellow, white and brown, with a distinctive leaf-like mark on the opisthosoma. In captivity female *Poecilotheria* spiders can live up to 8-12 years, while male spiders only live for about 2-4 years (Molur et al. 2008).

We are reporting a rare bite by an Indian ornamental tree spider (*Poecilotheria regalis*), also called regal parachute spider, which caused delayed appearance of severe and diffuse muscle cramps, lasting for three weeks. While searching the literature, we found that such symptoms are more the rule than the exception after *Poecilotheria* bites and conclude that they are of medical importance to humans, even if hardly reported. A comprehensive literature search revealed that the risk of *Poecilotheria* bites is strongly underestimated and therefore we combine this case study with a literature review on *Poecilotheria* bites.

2. Case Report

A 45-year-old male presented to the emergency room (around 3 PM) after having been bitten in the right index finger the night before (at 9 PM) by his pet *Poecilotheria regalis* (Figures 1 and 2), a six year old, 6 cm long female, while feeding her. He owns nine theraphosid spiders belonging to the genera of *Nhandu, Poecilotheria, Brachypelma,* and *Lasiodora*, and had been bitten 2 years previously by an *Acanthoscurria geniculata* (Brazilian giant white knee tarantula), describing the sensation to be comparable to a bee sting. He had also once been bombarded with the urticating hairs from a *Grammostola* species, which left a burning sensation comparable to nettle stings (*Urtica* sp.). There were no visible bite marks after this *Poecilotheria* bite, except for a slight erythema; and there was only a slight initial swelling, and no local pain. He suffered from intense hot flushes within 2 hours of the bite and was sweating profusely. Those symptoms resolved completely after a short time. 15 hours after the bite he developed severe muscle cramps, starting in the hands and feet, then spreading to the arms and legs, which is why the patient presented to the emergency room. The symptoms were turning into generalized muscle cramps, and he also complained of chest pain, which he described like a stabbing pain and a “contracting heart”. Creatine kinase was slightly increased at 370U/L (reference range 0-200U/L). ECG was normal. The patient was treated with oral lorazepam (dosage was not specified) and 2 mg intravenous midazolam, which decreased the symptoms sufficiently, with resolution of chest pain and decreased muscle cramps in the legs, that after five hours he insisted on leaving the hospital to go home. Yet, he took magnesium twice daily for three more weeks until the remaining muscle cramps in his hands resolved completely. Also, the spider was not injured, although it unexpectedly died 2 months after the incident.

3. Literature review

An intensive literature search revealed publications of eight bites of *Poecilotheria* species (Schmidt 1989; De Haro & Jouglard 1998; Gabriel 2002; Breitschwerdt 2005; Lieske 2005; Ahmed et al. 2009) and further communications of 18 bite reports in blogs of the arachnological community (Arachnoboards 2013; Bighairyspiders 2013; Poecilotheria 2013; Reptilesworld 2013). Spider keepers usually know the scientific names of their spiders correctly, even though some confusion cannot be excluded, as they usually know the spider by the name under which it was sold to them, which may be wrong. Yet, especially breeders are very reliable, and therefore we regard all these reports as "verified spider bites" (sensu Gnädinger et al. 2013 and Nentwig et al. 2013). These 26 bite reports refer to *P. regalis* (13 cases), *P. fasciata* (4), *P. pederseni* (2), *P. rufilata* (1), *P. subfusca* (1), *P. striata* (1), P. *ornata* (1), in two cases no species name was given. In 17 cases males were bitten, in 2 cases females (in 7 cases no indication of sex) and the persons were 22 – 55 years old (in some cases age was not reported). In all cases bites occurred due to handling mistakes while feeding the spider, cleaning the terrarium, making photos, or in situations where the pet keeper expected a different behaviour. Usually, the spider moved faster than expected or the pet keeper did not expect a bite from his/her pet. Bites occurred in 13 cases into a finger, in 7 cases into hand or arm, also once in cheek, thigh, shoulder each (three times not mentioned). All bites caused symptoms but no fatalities were reported.

Bites can easily be separated into two groups: without muscle cramps and with muscle cramps. 42 % of all bites did not cause muscle cramps. Symptoms were local swelling (50 %), erythema (50 %), and moderate pain (73 %) with an average severity of 1.1 (scale 1-3). Further symptoms were itching or burning sensations, nausea, sweating, stiff knees, fingers, neck, or shoulders, and tight chest or heavy breathing (one mention each). After 1 - 4 hours (1 patient after 1 day) the patients were asymptomatic.

58 % of all bites caused muscle cramps. In this group, symptoms were local swelling (60 %), erythema (53 %), severe pain (87 %) with an average severity of 2.3 (scale 1-3). Further symptoms were burning sensations, heat, fever, flu-like myalgia, heavy breathing, increased heart rate, and short loss of consciousness. Cramps began on average 10 h after the bite (range 0 - 24 h, additionally two records of 6 and 7 days). They ended on average 7.6 days after the bite (range 1 to 14 days, additionally one record of 4 weeks). Muscle cramps were generalized (5 cases) or major parts of the body (4 cases), and arms or feet (4 cases).

A variety of measures were taken and drugs were administered to counteract the symptoms of the spider bites. Bitten persons squeezed the bite location or the whole finger to “press out as much venom (and blood) as possible”. Keeping the bitten body part cold with ice water to "reduce pain" or warm with hot patches to "destroy the venom" did not bring any alleviation. Patients were treated with analgesics (Hydromorphone, Ibuprofen, Acetaminophen, and acetylsalicylic acid), antihistamines (Diphenhydramine and Cetirizine), corticosteroids (Prednisolone and Cortisone), and antibiotics. Also high doses of magnesium were frequently administered in different applications.

4. Discussion

Since 1995, the Swiss Toxicological Information Centre (STIC) has been contacted 10 times about *Poecilotheria* sp. bites, with two written feedbacks, both concerning *P. ornata,* with detailed information about the clinical course by the treating physicians, apart from the case reported here. In both of these cases the patients developed severe muscle cramps with delayed onset, which resolved after administration of calcium and magnesium and/or high doses of benzodiazepines. Elevation of creatine kinase was not reported. The symptoms lasted for up to 2 days. These cases are in line with the case report described here and also with the majority of cases detected in our literature review. 58 % of *Poecilotheria* bites are characterized by a delayed onset of severe muscle cramps, affecting the legs or (most often) the whole body, lasting for days and often only disappearing after weeks. In 42 % of cases, symptoms were mild and typical for theraphosid bites (Vetter & Visscher 1998; Isbister et al. 2003). This can best be explained by a "dry bite", i.e. the spider did not inject venom.

Bitten patients had been treated symptomatically with analgesics, antihistamines and antibiotics in addition to benzodiazepines and magnesium and/or calcium, but available evidence for the efficacy of one treatment instead of another is insufficient, and therefore no conclusive recommendations regarding the optimal treatment can be made

Delayed and long-lasting muscle cramps, accompanied by severe pain, can be regarded as typical for most *Poecilotheria* bites.. While most symptoms after *Poecilotheria* bites are within the range of "typical spider bite symptoms" (Nentwig & Kuhn-Nentwig 2013) or within the range of theraphosid bites (Herzig & King 2013), delayed onset and long-lasting

muscle cramps are not. What toxins are responsible for these strong effects, which make *Poecilotheria* medically relevant? To the best of our knowledge, there is no information on toxic compounds of *Poecilotheria* venom available. A web-based database on spider toxins (available at ArachnoServer 2.0) containing 916 toxins (201 from theraphosids) and a review on spider venom compounds (Kuhn-Nentwig et al. 2011) with 1618 records (275 referring to theraphosids) contain no information on *Poecilotheria.* Another explanation could derive from the venom quantity injected. *Poecilotheria* spiders are rather large and should therefore inject larger quantities than an average theraphosid. This is confirmed by Herzig (2010): He compares the milked venom quantities of many theraphosid species and shows that an average *Poecilotheria* species yields about 12 µl venom more than the average yield of other larger theraphosids.

The Swiss Toxicological Information Centre received information on 10 bites in 18 years and we extracted further 26 cases from the literature and blogs (Schmidt 1989; De Haro & Jouglard 1998; Breitschwerdt 2005; Lieske 2005; Ahmed et al. 2009, Arachnoboards 2013; Bighairyspiders 2013; Poecilotheria 2013; Reptilesworld 2013), covering 24 years, leading to an annual frequency of less than 2 reported bites. *Poecilotheria* species are frequently kept as pet spiders and a recent census records 6000 specimens belonging to 15 *Poecilotheria* species (Märklin & Kroes 2009) kept in Central Europe. One would expect frequent bites and accidents but this seems not to be the case. On the other hand, there is certainly some reporting bias or underreporting. Only three publications (Schmidt 1989; De Haro & Jouglard 1998; Ahmed et al. 2009) are regular publications in medical journals while all others were communicated in blogs of the arachnological pet community. *Poecilotheria* species are usually very shy and hide away. When they feel threatened, they display a remarkable threatening posture with elevated forelegs, thus showing their aposematic yellow stripes on black background of the ventral leg sides. In contrast, the dorsal colour pattern of *Poecilotheria* species corresponds to bark camouflage patterns. Even if bites are not frequent, ornamental tree spiders run very fast and their speed can be confounded with aggressiveness (Klaas 2007).

It is unknown why the venom of *Poecilotheria* (and perhaps of a few other theraphosid genera? Ahmed et al. 2009) is much more toxic to humans than an average theraphosid venom. It has been argued that arboreal theraphosids should have more potent venom, correlating with the necessity to rapidly paralyze large, struggling prey in an aerial

environment, without using immobilizing devices such as sticky webs (Escoubas & Rash 2004). Also, theraphosid spiders from the Americas should be less venomous than species from Asia and Africa (Escoubas & Rash 2004). While it is true that the toxicity of theraphosid spiders varies widely (Escoubas & Rash 2004; Mourão et al. 2013), it remains unclear if such conclusions can be drawn from a study where the venom of 55 theraphosid species was compared by intracerebroventricular injection into mice, no control was included, and all mice died at different times after injection. Also the number of Asian species (5 out of 55) is rather low (Escoubas & Rash 2004).

In general, most theraphosid spiders are regarded as harmless and their bites cause only minor problems, which is confirmed by reviews on theraphosid bites in Australia (Isbister et al. 2003) and Brazil (Lucas et al. 1994). Many American theraphosid spiders like *Brachypelma* sp. are even more feared as "bombarding" spiders that use their urticating hairs covering their opisthosoma in case of danger by brushing them with the hind legs into the direction of the perceived attack, so defensive bites are rarely necessary. It is advisable to stay outside the shooting range because these urticating hairs can cause dermatitis, keratoconjunctivits and asthma-like bronchitis (Blaikie et al. 1997; Watts et al. 2000; Choi et al. 2003; Spraul et al. 2003). Also, there is a report of pharyngeal irritation after ingestion of fried spiders, which, in some countries of Asia and South America, are considered to be a delicacy (Traub et al. 2001), although only the American species are likely to have this effect. Allergic reactions and sensitization have been described. All these symptoms can persist for quite a long time (weeks). There is no antidote available and treatment is symptomatic and supportive.

We were confronted with several limitations going through the available literature and mainly the bite reports from the blogs of different arachnological societies, the most important one being the retrospective character of our data collection. Also, there is most probably an underreporting bias, especially of dry bites.

5. Conclusion

Theraphosid spider bites are rare and generally mild with the exception of *Poecilotheria* species. The reason for a specific toxicity of their venom remains unclear. We are describing a case of a *Poecilotheria regalis* bite and the delayed onset of severe and diffuse muscle cramps that resolved completely with the use of benzodiazepines and magnesium.

Acknowledgement

We thank the patient for the detailed description of his symptoms, Astrid Klose for providing the photos and last, but not least the reviewers for their valuable comments.

Conflict of interest

The authors declare that there is no conflict of interest

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Figure 1. Female, adult *Poecilotheria regalis* (Theraphosidae) (dorsal view) (Photo ©Astrid Klose)

Figure 2. Female, adult *Poecilotheria regalis* (Theraphosidae) (ventral (aposematic) view) (Photo ©Astrid Klose)

Highlights

- Theraphosid spiders are coveted pets in Switzerland and Central Europe.
- Most theraphosid spider bites seem to be harmless.
- We present a case of a bite by *Poecilotheria regalis* with severe muscle cramps.
- A comprehensive review of the literature shows that *Poecilotheria* species are medically relevant.

Ethical statement

No ethical statement was required for this article; the patient gave his written permission to use his data.